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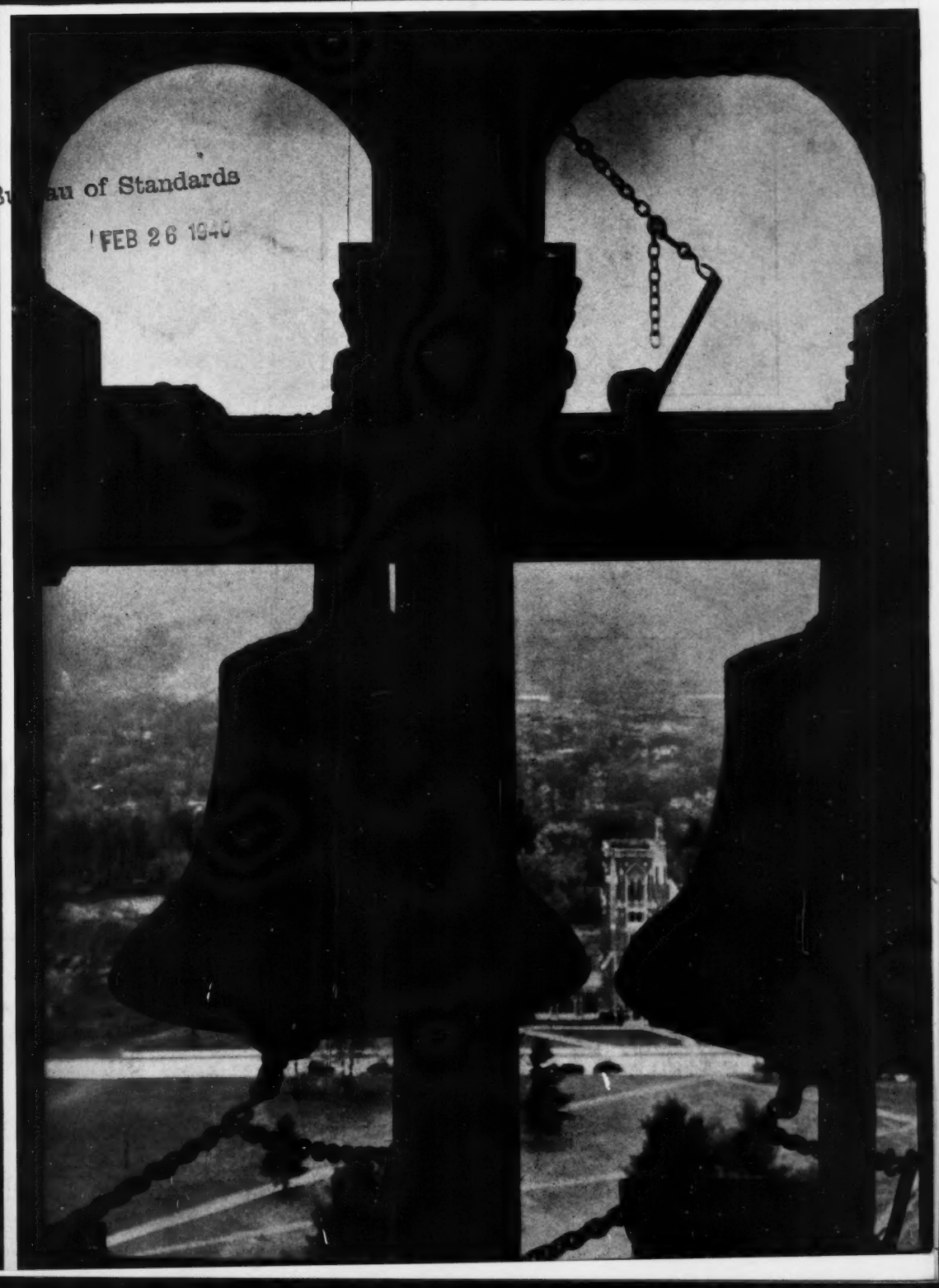

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This Month's Contributors

Major Willis R. Slaughter, Assistant Professor of Military Science and Tactics and instructor in Ordnance, is especially conversant with the subject which he discusses in this issue, having spent much of his life studying the industrial problems created by war. With World War II well on its way, his analysis and opinions are particularly timely to both the practicing engineer and the student engineer who must prepare to meet a war-ridden world.

Major Slaughter is a graduate of the United States Military Academy at West Point. Following graduation, he served two years in the infantry as a lieutenant and then transferred to the Ordnance division in 1922. The next year, 1923, found him taking a post-graduate course in Ordnance engineering at Massachusetts Institute of Technology. His life from that point on has been directly associated with ordance work with the exception of five years which he spent with the air corps.

Major Slaughter's education in ordnance work was continued by a year (1934-1935) of study in the Army Industrial College, an institution which prepares students for performing the function of supervising the procurement of all military supplies in time of war. Before entering Cornell University as a member of the faculty in 1938, he completed two years of work in the Picatinny Arsenal at Dover, New Jersey.

Professor John R. Moynihan's efforts in preparing students for jobs, and obtaining jobs for the students, have gained him the gratitude of many Cornell engineers. He explains the problems of the personnel department and the services which it renders.

John C. Page has long been connected with the federal reclamation program, holding many positions including that of office engineer on the Boulder Dam, before becoming the Commissioner of the U. S. Bureau of Reclamation, concerning which he writes.

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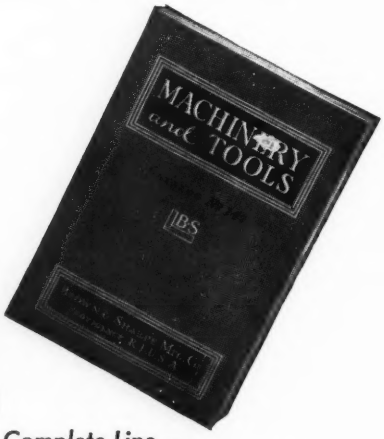

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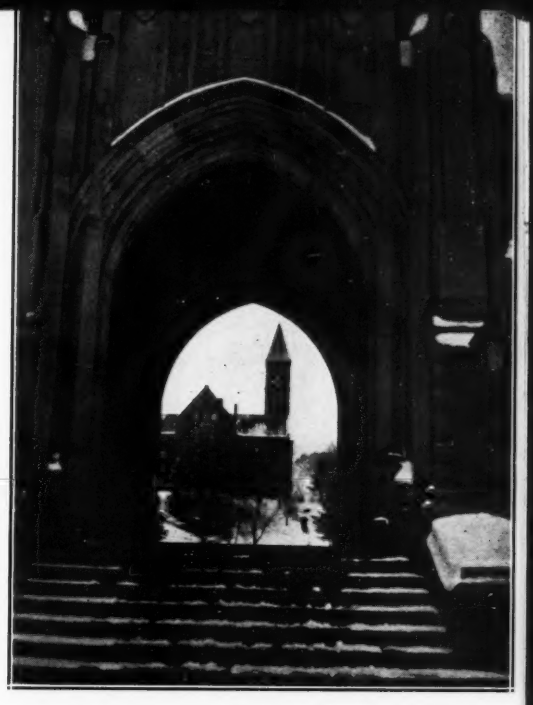

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Above is the library tower seen through the arch of the War Memorial.

•

COVER

Suggestive of the Christmas season is this silhouette of the famous library tower bells. This year, the playing of the chimes is being broadcast daily from 12:50 until 1:00 over the local station, and old Cornellians have an opportunity to hear again the music which is so much a part of daily life on the hill.

•

FRONTIS

Boring operation on a large lathe. Heavy machines like this would be the backbone of America's defense in case of war.

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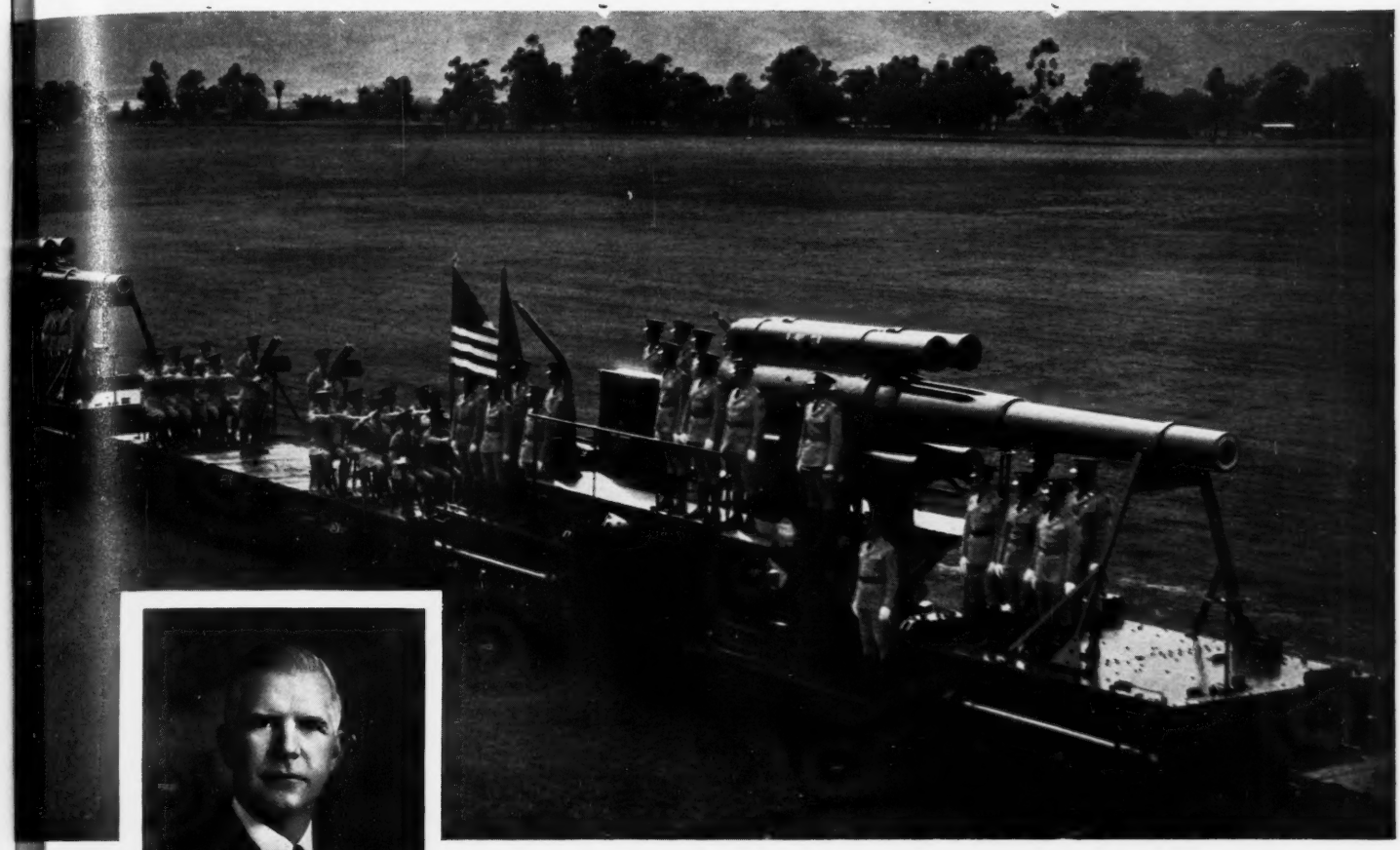
—Courtesy of Warner & Swasey

THE ENGINEER IN ORDNANCE



—Cuts Courtesy of Machinery

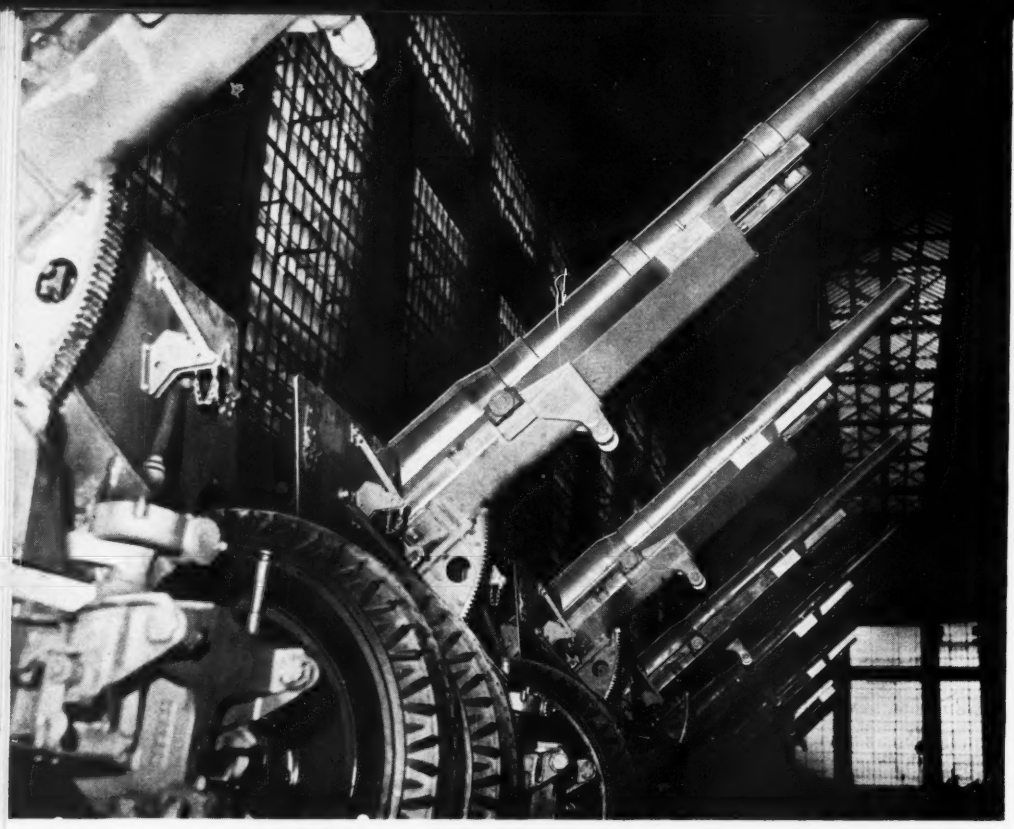
By MAJOR WILLIS R. SLAUGHTER, Ord. Dept., U.S.A.

Assistant Professor of Military Science and Tactics

Preparedness for war is the surest guarantee of peace. Our first President, George Washington, preached this doctrine over 150 years ago. Unfortunately, the country drifted along with no great concern until the complexities and magnitude of the World War forced some definite action. Up until that time, man power had been the principal consideration, then material came into its own, and today it is the equal, if not the greater problem. It is primarily an industrial question and covers a broader, more complicated field than does the assembling and organizing of armies. In general, a longer time is required to mobilize munitions than men, and industrial mobilization would set the pace at which the man power of the nation could be mobilized and used effectively in combat.

The experiences and costly delays of the World War resulted in the enactment of the National Defense Act of 1920. Included in this excellent legislation is a provision for an Assistant Secretary of War—the business head of the War Department. Under the direction of the Secretary, he is charged with the supervision of the procurement of all military supplies. In addition, he has the responsibility for the assurance of adequate provisions for the mobilization of material and industry essential to war time needs.

Under this legislative mandate, the armed services have proposed plans for industrial mobilization, which consider not only the needs of the Army and Navy, but those of industry and the civilian population. Mobilizing a nation for war is an intricate process. It involves every economic element of the nation—raw materials, manufacturing capacities, power, fuel, transportation, finance, and labor. These elements have to be coordinated in full support of the military effort. Any coordinating agency established, such as the War Resources Board, would be operated by civilian administrators appointed by the Chief Executive.



offensive and defensive implement essential to the successful prosecution of war. The diversity of the problem and its technical aspects are indicated by the fact that there are over 1,200 separate ordnance items, together with some 250,000 components. These items are non-commercial in character and embody in their design the application of practically every branch of science.

Warfare is increasing in complexity. Many of the new weapons present serious difficulties in manufacture. The capacity of the arsenals is decidedly limited and in a major emergency, they would not be able to produce 10% of the requirements. Industry, which would have to assume the burden, is normally unfamiliar with these products. The manufacturing methods are in many cases entirely unlike those used in commercial production of the plant's normal product.

Although Army and Navy officers, with the cooperation of qualified civilians, are responsible for the preparation of the plans, in time of war such officers would be engaged in the actual procurement of munitions.

There is no question but that this country wants peace. It is axiomatic that preparedness is essential to keeping the peace. The question has been raised what can the engineer do towards maintaining peace—preparedness. With entire nations and groups of nations being at each other's throats, the outcome depends more and more on industrial preparedness and applied sciences. The effectiveness of modern military forces is limited by the industrial support they receive, the extent of which will depend upon the efficiency of the engineering talent devoted to each project. Warfare is becoming more and more an engineering problem in which production of the huge quantities of materials required must be accomplished without delay. Therein lies a role of major importance for the engineer in national defense—the engineer trained in the fundamentals of his profession and able to apply them to scientific research, development and production.

The Ordnance Procurement Problem

From the Ordnance point of view, the procurement problem is particularly difficult. While much of the equipment required by the troops is of commercial nature, munitions are not. The Department has the mission of supplying the army with ordnance material (the fighting weapons), in the quantities needed and at the time and place required. This involves the design, procurement, and maintenance of practically every

Peace Time Planning

The first step in supplying the army is to determine the military characteristics of the types of munitions desired. This is followed by a program for design and development. There follows the preparation of specifications in sufficient detail for the manufacturer to produce the article. Conformity with commercial standards and commercial practice is diligently sought. Close liaison is maintained with national engineering and technical societies, and other agencies dealing with standardization of practices and material specifications. The second step is to determine the quantity requirements for the item. This is strictly a military question and depends upon the number of men mobilized, the rate of mobilization, and how the army is organized and equipped.

Knowing what items are wanted and how many are wanted at definite times, the questions arise as to where they can be obtained, and can they be obtained in the time and quantities desired. The Ordnance problem is of such vastness that it would be impossible to attempt the procurement of the thousands of items from a central office in Washington. For the purpose of decentralizing procurement, the United States has been divided into fourteen Ordnance Districts. The object of this decentralization of procurement operations is to secure an equitable distribution of the industrial war load throughout the nation according to capa-

cities. The Districts are organized with a Chief, a prominent industrialist, giving his time voluntarily, i.e., for a dollar a year. He has an Ordnance officer of the regular establishment as his Executive Assistant and the necessary clerical help. Reserve officers are assigned to the various duties they would be called upon to perform. The districts are for the purpose of surveying industry generally and for making a detailed analysis of each plant to be used to produce munitions.

The central office in Washington makes a tentative apportionment of the war time requirements to the districts based upon strategic considerations and upon estimated manufacturing capacity. The districts either investigate or have investigated available sources of supply to determine the facilities necessary for the production of the war load and recommend those facilities they deem best suited. These plants are assigned after all factors are considered—civilian needs, requirements of other services, technical ability, nature of production, and financial rating. Apportionments are adjusted between districts, if necessary, and finally the load is equitably placed in the manner best suited to meet military and industrial needs. Maximum use is made of existing plants, and to date some 20,000 have been surveyed, and 10,000 allocated. There must be new plant construction, however, particularly for powder and high explosives. The loading and assembling of ammunition presents an enormous problem, and practically a new industry would have to be created to care for this phase of the program.

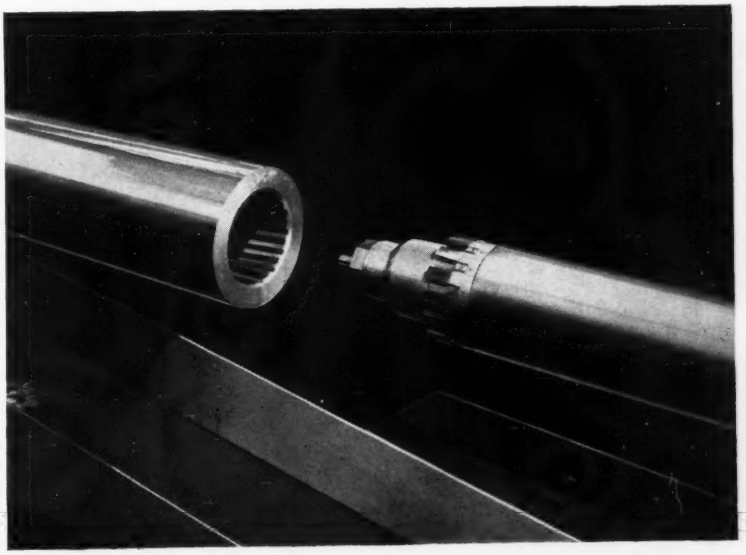
After a facility has been allocated, detailed surveys are made to determine definitely the type and quantities of munitions that could be produced for an emergency. This is followed by a written statement expressing the willingness of the facility to enter into an agreement with the War Department to produce certain items in definite quantities within specific periods of time. This schedule is in no way a contractural obligation and is not binding on the manufacturer nor on the Government. This contact with industry through the districts is the foundation of procurement planning. Manufacturers are acquainted with the task to be accomplished by means of specifications and drawings. Descriptions of manufacture and samples would be furnished. For non-commercial articles, factory plans would be prepared showing the steps in the transformation of the facility that would be required to begin war production.

THE ENGINEER

Very briefly has been outlined some of the more important steps in procurement planning vital to industrial mobilization and to preparedness. Now to answer the question of where the engineer fits into the picture. In considering the problem of research and development, it has often been stated that our armament should be at least the equal of that of any foreign country. Why not go further and state that it should be *better* than any other in the world? What a wonderful sense of tranquility and

—Courtesy American Machinist

Model 3.7 Anti-Aircraft Gun



Rifling Head that Cuts the Full Length of the Bore in Gun Tube Liners, Fourteen at a time.

peace of mind this country could enjoy if such were only the case! The best ammunition, the fastest tanks, the most mobile and powerful guns! The competition would be against the keenest minds in Europe and Asia because there is hardly a university or a research organization abroad which is not actively engaged on some military problem. The ability, the agressiveness, and the initiative of the American engineer has never been in doubt. They hold their own with any nation and as their improvements and advances become usable to military purposes they are adapted to producing more efficient armament.

Certain research activities must be carried on directly by the Ordnance Department because industry itself conducts no research along such lines. In this category comes the science of interior and exterior ballistics, fire control development, tracks and track suspensions for high-speed track laying vehicles, and the cooling of engines under adverse conditions (as in a tank.) For this reason, the Ordnance Department maintains research laboratories at Watertown Arsenal for metallurgy; Picatinny Arsenal for chemistry and explosives; Frankford Arsenal for optics, acoustics, and nonferrous metals; Aberdeen Proving Ground for ballistics and automotive; Rock Island Arsenal for oils, and cleansing and preserving materials. Funds for research have been limited, but the accomplishments have more than justified the expenditures. It would be ideal if the research engineer could do his work far in advance of any war emergency, and in the unhurried atmosphere of peace so that his contributions would be available and perhaps in use should an emergency arise. Under the pressure of actual war, development is intensified and the research laboratories and design offices are forced to operate at full speed.

Weighing and Gauging a Shell

The quality of our munitions is of vital importance and we must give the man at the front the very best obtainable. Perfection is the goal, but even a perfect product, unless it can be turned out by industry in sufficient quantities and in the required time, is of no use. There must also be a suitable balance between the refinements of design and the capabilities of industry. Our designs must be based on the use of commercial materials and capable of being produced so far as possible by commercial processes and methods. The industrial engineer insures this for the arm and furnishes the balance to the military engineer. Drawings and specifications must be carefully scrutinized from the production point of view to insure that the articles may be readily manufactured. One of the most important requirements is that the item be adapted to quantity production in an emergency. Standard grades, sizes, kinds, and qualities of commodities are insisted upon to increase and assure the flow of production of these commodities and to eliminate unnecessary sizes and varieties. The principals of simplified practice are considered, which is the elimination of excess or unnecessary dimensions, types and immaterial differences.

Many specifications are excellent for peace time procurement, but are too strict for war procurement under the conditions of quantity production. Specifications should be examined to see that they are no more severe than those which would be used in time of war. In this connection, specifications for ammunition are particularly difficult to prepare. In peace time, great emphasis is laid upon safety features, and the aim is one hundred per cent safety with as high a per cent functioning as possible. In war time, as much emphasis would be placed upon safety, but it is also essential that the ammunition function. Embodied in the same design, therefore, are essential features which are naturally in opposition to each other. In spite of this, the engineer should insist on the specifications being approved as it would be used in war.

From the start of mobilization until the new products arrive at the front, is the critical period during which troops can be supplied only from war reserves. It is generally accepted that with the best of planning, it would take at least twelve months to convert potential capacity into mass production of the more complicated items. Valuable time would be lost in re-tooling and in furnishing special machines and equipment. All measures must be taken by the production engineers to assure that this time is held to a minimum. Such assurances might go further than the examination of drawings and specifications to see that an item could be produced. It might be necessary to say that if a particular item is essential at a certain time, then the design would have to be changed to facilitate production.

(*Continued on page* 25)

EMPLOYMENT AFTER GRADUATION

A Discussion of the Seniors' Greatest Problem, Which Should Interest Every Engineering Student

By PROFESSOR JOHN R. MOYNIHAN

During the next few weeks the seniors in the College of Engineering will become conscious of increasing activity in college employment. The 1940 recruiting season, which started slowly in November, will gain momentum during the winter months, reach a peak in April, and then slowly decline into the late summer months. During this period several hundred companies located throughout the nation will visit or correspond with a majority of about one hundred engineering schools for the purpose of selecting future engineers from some nine thousand graduates. Naturally only a small fraction of the total number of representatives will visit each college, because the smaller companies usually visit nearby schools. In addition to the visits of the interviewers to the colleges, the invasion of the industrial plants by seniors will continue throughout the year, particularly at vacation times. All of this brings to mind the hundreds of questions to be answered and rumors to be usually denied by those of us who are engaged in the personnel service at the universities. It is the purpose of this article to answer some of these questions.

Factors Stressed in the Selection of Graduates

Probably the most important question in the minds of the seniors is this: What factors are stressed by the average employer in the selection of engineering graduates? The answer to this question is contained in the following table which represents the results of a recent survey:[1]

	Research Development Design	General Engineering	Operation Production	Engin. Sales
Scholarship	57	38	34	22
Personality	21	31	32	49
Extra Curricular Activities	6	10	12	15
Working Experience	10	13	15	7
Degree of Self Support	4	5	5	4
Outside Influence	2	3	2	3
	100	100	100	100

(1) A SURVEY OF COLLEGE EMPLOYMENT PROGRESS FOR 1939 by J. R. Moynihan.

This table represents the average opinions of twenty-nine persons engaged in placement work at a like number of engineering colleges. As might be expected, scholarship is emphasized more for highly technical work than for engineering sales, while the reverse is true of personality and extra curricular activities. The importance of high scholarship in the consideration of seniors by prospective employers is shown by these results. These results substantiate the experience of the College of Engineering at Cornell. A study made last year for the purpose of determining the relationship between scholarship and offers for the Class of 1937 in Engineering here at Cornell shows the importance of scholarship.

Engineering Graduates—Cornell University—1937
(113 degrees)

Scholarship	*Offers per Man*
First Quarter	4.0
Second Quarter	2.1
Third Quarter	1.5
Fourth Quarter	1.0

The next factor stressed, namely, personal characteristics, is important even in research. Here at Cornell we attempt to correct any faults in the personal traits of our students by means of our established personnel system. In order for this system to operate successfully, the results of personality surveys on each student are not made available to the interviewer but only to the young man himself. However, opinions of personality are sometimes sought and given to the interviewer by the faculty adviser. The very fact that a student's personality is difficult to appraise and is judged by the manner in which he affects the interviewer is often an advantage to the senior, because at that time the other factors such as scholarship, activities, and experience are established, and deficiencies in these can only be overcome by an excellent personal impression.

The third factor listed, extra curricular activities, is most emphasized in engineering sales, as might be

The Interview Where the Graduate Must Sell Himself to Industry

expected, while working experience is most desirable for those men that choose the field of production. The degree of self-support aids to some extent, while outside influence or "drag" counts very little in the eyes of the interviewers.

To summarize this phase of the selection of young engineers, the employer is looking for a well-balanced man of good character, whom he expects to be successful. He knows from experience what to seek in men. He will compromise to some extent if the lack of one factor is compensated by another that is outstanding. The reason that some engineers are unsuccessful in industry may be traced to inability to get along with others, impatience with progress, and lack of aptitude for a particular type of work. Thus the employer will select men whose records and personalities indicate that they will not develop these faults in the future.

Employment Demand in Various Vocations

Another question frequently asked is: What vocations in engineering are the most active? The following table is taken from the survey previously mentioned and represents the results from twenty-two institutions for the Class of 1939:

	Percent of 1939 Class	Activity Compared with 1938
Research	6.7	More
Development	8.5	Same
Design	11.8	Same
Teaching or Grad Work	8.6	Same
Construction	10.3	Same
Operation	14.4	Same
Production	13.4	Same
Applied Economics	0.5	Same
Engineering Sales	13.3	More
Training Course (No definite vocation in mind)	12.5	Same

The impression gained from this table is that the distribution of 1939 engineering graduates is comparatively even throughout the various vocations. The results of the 1939 Class of Cornell alone show that the percentage in training courses with no definite vocation in mind and in engineering sales is higher that the nation average, while the number employed for design and construction is below the average. An attempt is made at Cornell to assist the seniors in determining the type or types of work for which they are suited and in which they are interested. Sometimes it is not possible to accomplish this, but in many instances it is apparent for obvious reasons that a certain young man should seek employment in engineering sales as opposed to research.

Industries Most Active in the Various Fields of Engineering

Another question often asked is: What industries are most active in various fields of engineering at the present time? This is best answered by the results of the same survey for 1939.

Field	*Industries Most Active in Each Field*
Aeronautical	Aircraft Mfg., Aviation
Architectural	Building, Government
Chemical	Oil, Chem. Mfg., Plastics, Rubber
Civil	Construction, Highway, Steel, Government, Small Building
Electrical	Utilities, Electrical Mfg., Large Equip. Mfg.
Industrial	General Mfg., Steel, Oil
Mechanical	Gen. Mfg. of Large and Small Equip., Steel, Oil, Avitaion, Automotive, Utility
Metallurgical	Steel
Mining	Coal, Gold, Petroleum

The industries are given in the order of their activity. We will probably see little change in the order this year, so that a majority of seniors in each field of engineering may expect to find employment in the types of industries listed. For the benefit of those undergraduates seeking employment, we have available in our Personnel and Employment Office the names of companies active in each field, listed alphabetically and geographically, together with information as to products, size, types of work, plant locations and the names of persons to contact.

Starting Salaries

We often hear the question: What starting salaries do the young engineers receive? The answer is shown below in the average starting salaries on a monthly basis from twenty-nine institutions for the past three years.

	1937	1938	1939
First Degrees	$123	$117	$124
Advanced Degrees	152	149	149

The range of starting salaries for 1939 engineering graduates varied from $80 to $180 for the first degrees and from $120 to $250 for advanced degrees. This is due to the fact that salaries are higher in the East than in the Midwest and South, and sometimes the men with the better records will receive higher salaries. While the starting salary is relatively unimportant when compared with future oportunity, still salary should be a consideration if it is not in line with offers from the other companies.

Treatment of Young Engineers by Industry

Very often the college personnel adviser or even the industrial interviewer himself will be asked: Is it true that certain companies will hire many more men then they actually require for permanent employment, and after a year or two dismiss the balance? While there may be a few isolated cases of this type, more in the past than at present, the answer lies in the fact that the companies which are progressive enough to seek young engineers from the universities are certainly not going to adopt this shortsighted policy, particularly when these industries devote much time and energy to training programs and personal guidance during the first few years of internship. Also it is a fact that the companies most satisfied with the young engineer are those that are the most conscientious in selecting men. Others, unacquainted with the limitations of an engineering education, are inclined to expect too much and may become dissatisfied with the neophyte engineer.

The universities are interested in the progress of the young engineer, and many schools such as Cornell conduct a follow-up plan which consists of mailing circulars to the class at the beginning of each year for five years and then at five year intervals to learn of their work, success, and desires as to change in position. A brief description of this plan and the alumni placement service of the University may be found in the November 1939 issue of the CORNELL ENGINEER.

Recent Placement Results

Many undergraduate engineers are interested in the placement results during the past few years. The results given below represent the returns from thirty-five schools of engineering representing over fifty percent of all of the 1939 engineering degrees. This information is taken from the previously mentioned survey.

Percent of Entire Engineering Class Placed

	As of June 15	*As of Sept.* 15
1937	81.9	93.5
1938	60.3	85.2
1939	63.4	89.3 (Estimate)

This table shows that during the past two years many of the engineering graduates have accepted positions during the summer months following commencement. If one compares these results with the average business activity during these years, it will be observed that the employment of engineering graduates fluctuates with the business index. The season of 1937 was considered excellent, that of 1938 only fair, and 1939 good. During a year such as 1938, the final placement results also indicate that there was a considerable decrease in the number of offers of positions made to the seniors. The nation-wide offers in 1938 were only 67.5 percent of those made in 1937, while the offers in 1939 were 82.2 percent of those made in 1937.

The placement results for the College of Engineering at Cornell as of September 15, 1939 were presented at that time, but are repeated below as a matter of general interest.

Percentage Placed

(includes those taking graduate work)

Administrative Engineers	91%
Chemical Engineers	100%
Civil Engineers	96%
Electrical Engineers	95%
Mechanical Engineers	98%
Total Placement—College of Engineering	95%

Class	Number in Class	Positions Accepted	Graduate Work	Number Unemployed
ADMINISTRATIVE				
Electrical	3	3	0	0
Mechanical	30	26	1	3
CHEMICAL	8	8	0	0
CIVIL	27	26	0	1
ELECTRICAL	22	21	0	1
MECHANICAL	40	33	6	1
	130	117	7	6

Efforts of the College to Assist Students in Obtaining Employment

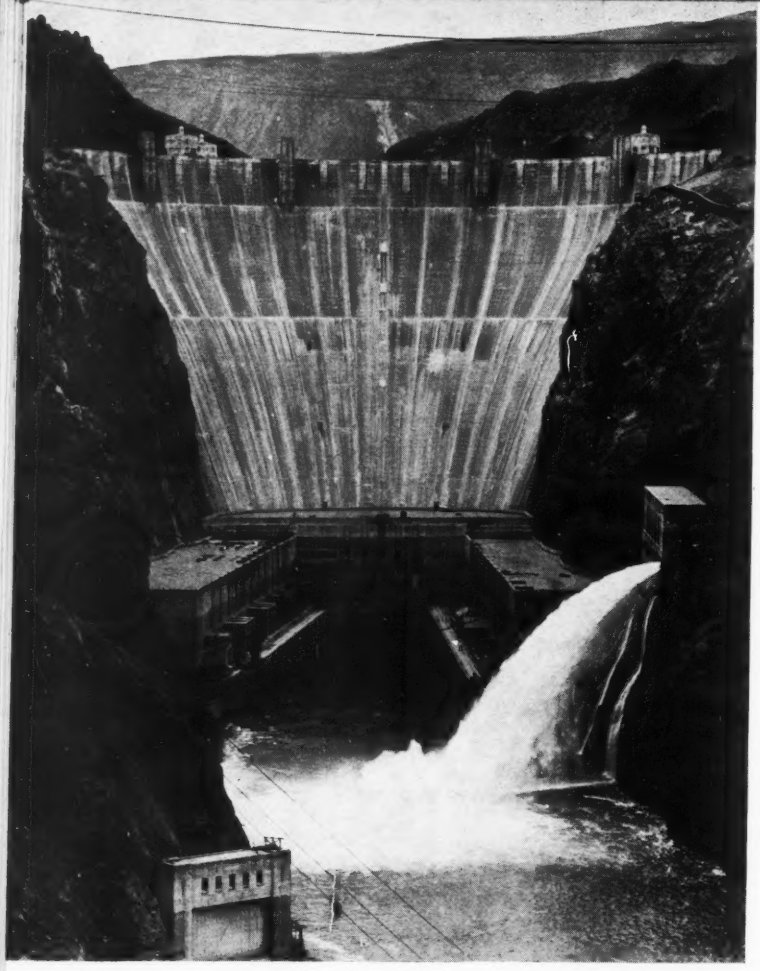
While the seniors are well aware of the efforts of the College of Engineering to aid them in this important problem of employment, many others are unfamiliar with this service. The College maintains a Personnel and Employment Office where this work is centralized. This office, which is located in the remodeled first floor of Sibley Dome, works on a cooperative basis with the University Placement Bureau. Private interviewing rooms are provided for visitors so that as many as five simultaneous interviews may be conducted by company representatives. The personnel and employment work in each of the four schools of Chemical, Civil, Mechanical, and Electrical Engineering is conducted by a faculty member designated as Personnel Adviser.

During the freshman year the personnel and employment system is described and the advantage of a good record is emphasized in lectures. Then in the sophomore as well as the freshman year, personality ratings of the students are obtained from faculty members. The juniors and seniors are rated on personality by a committee of their own selection, consisting of five faculty and five students. During the junior year, a survey is made to determine the plans of this group for the next summer and to assist them in securing summer work.

Early in the senior year each senior is interviewed by the personnel adviser. In this interview the senior is acquainted with the details of the employment system, his personality rating is returned, and he is given vocational guidance counsel. Informal contacts are maintained with the seniors throughout the year.

In the office itself are prepared the information booklets containing the activity and scholastic records of the seniors. These, together with a class picture, are available to prospective employers and are very

(*Continued on* 27)



BOULDER DAM

RECLAMATION AND THE ENGINEER

• The Application of Engineering Principles to the Federal Reclamation Program.

By JOHN C. PAGE, C.E. '11

Commissioner of U. S. Bureau of Reclamation

This country can always use all the good engineers it can get. The tempo of today's life is geared to their work, and in a large measure their work determines our attainment of an ever higher standard of living.

To lay down the exact dimensions of what makes a good engineer would be presumptuous. Too many human and incalculable factors enter the picture. At the risk of over-simplification, I should say that in my opinion the three essentials of a good engineer are a sound education, a love of his job, and vision.

By a sound education I do not necessarily mean the acquirement of other degrees before a C.E. or an M.E., although I believe that the engineer who has studied his social and related sciences is better equipped for his lifework than the one who hasn't. I wish rather to place my emphasis on the necessity for a complete mastery of the principles of engineering, for upon this theoretical foundation is erected every structure the man builds later. It is his bedrock, and it must be sound, lest his future structures be shaky.

Furthermore, a sound education implies considerable past mental application. To master any subject fully, to pass an examination with flying colors, requires intensive study; the student must be prepared. To master fully all the principles of engineering requires continuous effort and repeated preparation, until preparation becomes a habit.

In the work of the Bureau of Reclamation, that habit is considered absolutely necessary. We insist on complete and thorough preparation for every job to be undertaken. Reclamation projects must be adequately investigated from every angle before they are built. Patient study, sometimes spread over years, must precede the beginning of construction.

An actual instance is the Owyhee project, Oregon-Idaho, one of the first reclamation developments to receive the Bureau's attention after the establishment of the Bureau by the Congress on June 17, 1902. Construction of this project was not begun until 1928. A quarter of a century of topographic, geological, hydrometric, economic, agricultural, legal, and other studies antedated actual construction.

In the Bureau of Reclamation, we look well before we leap. Only in this way can we insure to the best of our ability that the investment of the United States Government in a reclamation project will be fully repaid, for under the Reclamation Act governing the work of the Bureau every penny spent on irrigation construction must be returned to the Treasury, usually within a period of 40 years.

Adequate preparation, a sound foundation in other words, makes for success. This rule applied to all Reclamation work may explain why no dam ever built by Reclamation engineers has failed, and why Reclamation's reimbursable irrigation projects as a whole are successful.

Equally necessary, we consider, is the second essential of a good engineer—a love of his job. After all, it is the love that a man has for his work that impels him to throw himself into it, heart and mind, that creates in him a determination to do it well, that urges him to stay with it until it is done.

The third essential of a good engineer today is vision. A good engineer, in addition to being as adept as ever with his slide rule, his transit, and his blueprints, should have a broad social consciousness of this era's work.

It is as important to the Nation as to the engineering profession that engineers be developed with this additional qualification of vision, topping off a sound technical knowledge and a love of their job. It is important because of our modern high-speed industrial economy needs trained engineers who have the vision to help direct the country along a straight path to its true destiny.

The Bureau of Reclamation has in its charge the execution of one of the great social programs of the country today. Throughout its long history, the fundamental purposes of the Bureau of Reclamation have been the provision of homes and opportunity for our people and the development of the West through the conservation of the meager water resources of this arid and semiarid region.

But the Bureau's conservation program is only a segment of a still larger and broader objective. And whether the problem is reforestation of mountain slopes, control of erosion in the fertile plateaus, abatement of pollution in eastern rivers, rehabilitation of wildlife, aid to navigation on inland waters, flood control, irrigation or any of the others which must be solved in a prudent, long-time use of our natural resources—contrasted with the exploitation of these resources for temporary and immediate gain—it involves engineering problems. The work of the engineer in the solution of these problems is one of the threads which ties them together.

It obviously is important, therefore, for the engineer to understand these problems and help develop plans for their proper solution. It no longer is enough for the engineer to know how to build a dam; if he is to fulfill his highest potentiality, as a good engineer, he must also know why the structure is to be built, and he should be in a position as well to pass upon its purpose.

A top-ranking engineer once told me that years earlier, he had worked on the problem of designing a water-retention system in the Sierra Nevadas of California five years before he knew who expected to build the system and for what purpose the water was desired. He merely applied his training and skill to the abstract problem. Under such circumstances, his contribution could have been no more than a perfection of the engineering drawings.

At a session of the National Wildlife Institute, which I attended, a leader in the work of that organization reported that one of the most pressing needs in his field was skilled engineers familiar with the objectives of the organization, upon whom this group of conservationists could rely for guidance.

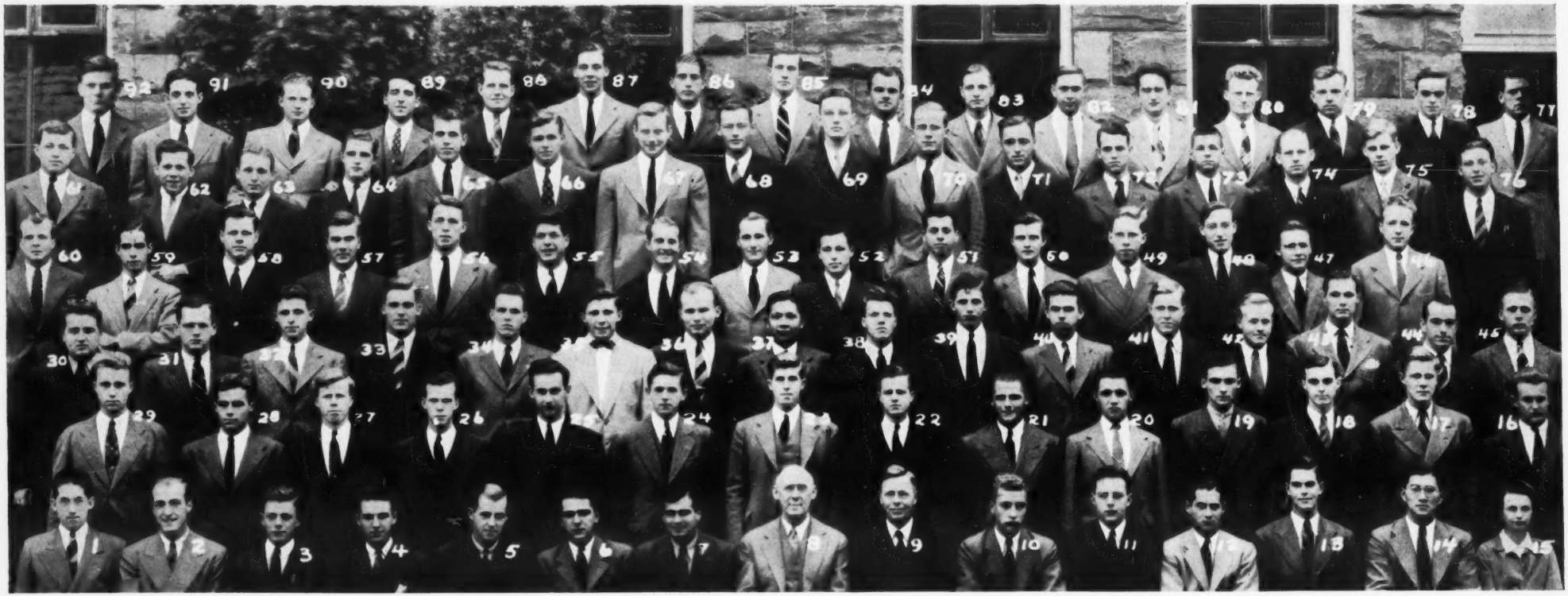
This holds true throughout the scale of conservation. Curtailment of soil erosion involves the construction of protective works, of check dams, and other structures. Flood control in many instances can best be accomplished by the building of dams and channel improvements—engineering work. Protection of the public ranges from overgrazing, one of the latest conservation activities, requires the improvement of stock-watering facilities, another job for the engineer. Abatement of pollution is more work for the engineer in design and construction of disposal plants, in relating the flow of streams.

In the Reclamation phase of the conservation program of our country, the engineer plays a star role. The Bureau of Reclamation is engaged in the construction and operation or supervision of the operation of 60 irrigation projects or divisions of projects in 15 arid and semiarid western states which will ultimately convert 5,300,000 acres of desert to productive farms.

The construction program of the Bureau of Reclamation during the fiscal year 1938-39 was the largest in its history. The Bureau had ten storage dams and one diversion dam under construction. It also built 356.2 miles of canals, 138.8 miles of drains, 32 tunnels with a total length of 31,783 feet, 753.6 miles of roads,

(*Continued on page* 26)

Boulder Dam In Construction



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MOTORLESS FLIGHT AT CORNELL

Gliding Assumes An Important Position Among The Extra-Curricular Activities on the Hill

By COLIN C. ELDRIDGE, M.E. '41

Even in these days when many in other parts of the world gaze apprehensively skyward, there is one field of flight which is devoid of roaring motors and the answering bark of anti-aircraft guns. That is the silent, wheeling flight of the soaring glider. This sport, which has an international following has 10,000 exponents in the United States alone. In Germany and Russia where fuel is at a premium, gliding has been subsidized by the government with the aim of training reserve military pilots. In the United States gliding still retains its status as a sport and the majority of its devotees fly for the sheer enjoyment of matching their skill against the vagarities of the wind.

"The feel of the air" and mastery of those currents which actually lift him are two of the modern glider-man's contributions to the science of air navigation. By his following the flight of birds, the glider pilot has accomplished much in the development of aero-dynamics. Experiments are now being carried on in the navy to see if glider training will reduce the cost of training and produce better pilots. It has been shown that a glider trained pilot is a better pilot not only because he is more skillful at the controls but because he has a better knowledge and respect for the medium through which he is flying.

There is a distinction between gliding and what is known as sail-flying or soaring. During a glide the plane starts from an attained altitude and steadily loses height until it lands. Thus time in the air and distance covered are very limited. Soaring on the other hand, is flight in which the machine is lifted upwards by rising air currents and thus maintains or increases its altitude. All outstanding records have been made by this type of sail-flight. If the velocity of the vertical component of an air current is equal to or greater than the "sinking rate" of the glider, then soaring is possible.

There are three types of soaring. The first and most common is "slope soaring." This makes use of the winds deflected vertically upwards by a ridge or bluff. Usually vertical air streams created in this manner are of sufficient intensity to allow soaring up to three times the height of the hill which deflects the air steam. Sometimes the deflected currents caused by a house or barn will give a pilot enough increase in altitude to measurably prolong his flight.

"Thermal soaring," or making use of rising convection currents set up by radiation and reflection of the sun's heat from barren spots on the earth's surface is a second method. Soaring across open country is done in this manner.

The third type is known as "cloud hopping" and consists of guiding the plane in the rising currents beneath cumulus clouds. Some of the longest cross country flights are made in this manner. A variation of this is storm cloud flying in which the machine rides the turbulent up drafts in front of a storm. Needless to say, this is practiced only by veterans.

Soaring records are measured in three divisions: duration of flight, maximum altitude, and airline distance. Flights of well over fifty hours have been made. Distances of well over 400 miles and altitudes of 28,000 feet have been attained in motorless flight. For example, Richard duPont made a flight from Elmira, N. Y., to within sight of the skyscrapers of New York City in a motorless plane.

Three distinct types of gliders have found use in the United States. The first is the primary or training glider. It is a machine with an uncovered fuselage

The Club's Franklin Utility Being Disassembled for Packing on the Trailer

designed for preliminary training only. Its greatest advantages are its stability, ability to stand abuse, low initial cost, and ease of repair. Only under the most ideal conditions will it soar.

The "utility" is a glider combining the ruggedness of the primary with the performance of a sailplane. The fuselage is enclosed and affords some protection to the pilot in case of a crash. This is the best all around glider. Although its performance is not exceptional, it is capable of extended soaring flights and is as satisfactory for training as the primary. This type is most suited to club use because it can be used for both soaring and training. Also, when students have learned to fly, a set of high performance wings can be constructed and the club will have a creditable sailplane.

The sailplane is the prince of gliders. It is a highly streamlined and efficient machine designed for the best possible performance with initial cost usually a secondary factor. A sailplane may weigh from 200 to 300 pounds and have a wing spread of 20 square yards. The conspicuous feature of a sailplane is its very long, narrow wings which sometimes extend as much as 60 feet in length but might be less than 5 feet in width. Broad wings would create too many eddy currents. A well designed sailplane has a sinking speed of less than two feet per second when gliding forward at an air speed of around 35 miles per hour.

The cost of a glider runs from $600 for utilities up to $2000 for sailplanes. Kits are now on the market for assembling one's own utility glider for as little as $400.

Gliding is considered the safest of aircraft activities because flying speeds are comparatively low and usually if left alone, a glider will practically fly itself. However, with due regard to aviation accidents, the United States Government through the Civil Areonautics Authority exercises control over all glider activity. Before one is allowed to take a glider off the ground, he must secure a Student Glider Permit. He can now be taught to glide by a commercial glider pilot. The second step is the Private Glider Certificate for which requirements are more exacting. The last stage is a Commercial Glider Pilot License under which the bearer may teach others to glide. A notable difference between power plane licenses and glider permits is that the physical requirements for gliding are not as strict.

Gliders may be launched into the air by several methods. Sometimes they are literally "snapped" into a ridge current by heavy elastic cords. A second method is by towing the glider across a field either by a winch or automobile. The glider rises in much the same manner as a boy's kite. The third and best way is by an airplane tow. Here the glider is towed to the desired elevation by an airplane, the cable detached, and the glider flight then begins under the most favorable circumstances.

One spectacular phase of gliding which is being experimented with widely is the use of "sky-trains." The practical aspect of such experiments can not be overlooked as more and more attention is being drawn to all types of air transportation. When three gliders are towed by one plane, they are usually attached to cables of different lengths, so the four machines form a diamond pattern against the sky. Occasionally, two gliders are attached in tandem. Glider trains have made transcontinental tours, and a flight has been made from Key West to Cuba.

Practically all of the glider pilots in the country today have learned to fly in clubs. Since several men are required to handle the craft on the ground, and because of the excessive cost of servicing and upkeep, the only way in which ships could be operated was for a group to work together and pool their resources of finance and labor. Gliding and soaring, in the past, has been a poor man's sport. On upkeep, experience has shown that the cost will vary from 10 to 30 cents per flight. The average person is usually very much surprised to learn that 90% of the students trained in gliders have learned in single place ships, with remarkable safety records.

Last month the Cornell Engineer traced the early years of gliding at Cornell. Immediately after the First World War enthusiasm in aviation at Cornell gradually died out. In 1926, Dr. F. B. Wright, Professor of Agricultural Engineering, with the aid of interested students laid plans for a club to promote interest and foster activity in flight at Cornell. The club had a great handicap from the start since the University, at that time, would not permit students to fly under auspices of the club. However, a ground school was begun in Sibley College with an enrollment of about 40 students. Members of the faculty offered their services as instructors. Since the key activity of actual flying was barred, the club had a difficult time maintaining interest and when the depression came on, money became too scarce even for ground school "flying" and the club lapsed into inactivity.

The present Ithaca Gliding Club which numbers 12 active members and possesses its own glider had its beginning back in 1937. Originally named the Cornell Gliding Club, it was started by Udo Fischer, '39 ME. Fischer was an experienced glider pilot before he came to Cornell. In fact he won the Western Championship in 1936 by virtue of his 10 hour flight at Sleeping Bear Dune, Empire, Michigan, using the same glider now used by the Ithaca Club. In the summer of 1938, Fischer went to Germany where he did considerable gliding especially with power-plane towing. On the fourth of July of the past year he had

The Ship Completely Knocked Down and on the Trailer

the hair-raising experience of having to "bail out" of his Wolf sailplane. While flying through a cloud his machine started to "buck and vibrate in an extremely violent manner." Unable to control his plane and fearful that it might collapse, he unloosened his safety belt to be able to "bail-out" if necessary. A sudden lurch, and he was tumbling through space. The surmise is that he was at the time flying upside down, but was not conscious of the fact. He landed safely in a field and his ship came down five minutes later in the same field with very slight damage, having just about landed itself.

The glider club's present craft is a Franklin Utility Glider which was purchased from Udo Fischer when he bought his German-made Wolf sailplane. The Franklin was built in 1930, one of the earlier gliders of its model. Fifty one gliders of this type have been constructed. No other American glider has been built in anything like this quantity. The ship has had five earlier owners including Richard duPont. While duPont owned it, it was used as a "car" in an air train from Key West to Havana as a demonstration of glider towing. For the trip, the Franklin was marked "First International Sky Train" and the caption on the fuselage has been carefully preserved by succeeding owners.

The Club has been fortunate in being allowed to use the Ithaca Airport as a base of operations during the past year. Four members have qualified and have received certificates as private glider pilots. The members have learned the fine points of gliding from one another with Udo Fischer acting as the first instructor. Many of the members have had previous instruction with power planes. However, this is not necessary to become a glider pilot. The control of soaring planes is the same as power planes, and flight is governed by the same basic forces, except there is no motor to help and the glider pilot must exercise his own talent and knowledge to fly where he desires.

The glider is launched from the Ithaca Airport by towing behind an auto until it has gained speed and soared up to the height desired. Over 200 tows have been made since the organization of the club under its present title. The airport has a 2700′ paved runway which permits plenty of room for practice. That learning the art of gliding is not difficult is shown by the performance of the members who with less than a month's experience in gliders entered the American Open Soaring Contest at Frankfort, Michigan and made a notable record. The Cornell entry in this meet placed third.

For traveling, the club has constructed a trailer for carrying their glider. The glider can be dissembled and loaded in 15 minutes. With this mobility, the club has been examining the possibilities of good ridge flying locations in the vicinity of Cornell. A site has been discovered just north of the village of Caroline near the spot where Cornell ski teams practice. On October 21, 1939 six flights ranging from 3 minutes to 30 minutes in length were made at this locality. Further use of this site will be made next spring.

For launching on rough ground where an automobile tow cannot be used, a power winch is sometimes employed. Prof. C. W. Terry of the Automotive Engineering Dept. at Cornell who is faculty advisor and instructor has been busy devising ways and means of constructing a winch for the use of the club.

A team was entered in the "Snowbird" Meet held at Elmira on Nov. 24-26, 1939 which placed sixth in the meet with a flight of one hour and one minute. However, the early darkness of winter days is not conducive to good flying and class schedules usually conflict with activity earlier during the day. Because of this there is not much gliding during the winter months and members devote themselves to ground school study.

But the advent of spring and lengthening of daylight hours will find "Skytrain" again silently floating over Ithaca. Or if the wind does not happen to be blowing in the desired direction, it is but a simple matter to pack it on its trailer with but a short run to Elmira with its famous soaring sites, or over to Cornell's "own" site in the Caroline hills.

EDITOR'S NOTE: This article is a sequel to "Gliding at Cornell by Ruth E. Dynes, '42, which appeared in the December issue. Miss Dyne's article traced the activities of the Cornell Gliding club which flourished shortly after the turn of the century.

We are indebted to Professors C. W. Terry and L. C. Petry for their aid in compiling material for this article, and to Professor Terry for the illustrations of the Ithaca Glider Club's Franklin Utility.

The Cornell Engineer

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Editorial

Now and then we cannot help but burst forth with a little advice aimed at the student body. The matter which has come to our attention of late is the attendance, or rather lack of attendance, at the numerous lectures on engineering subjects which are given on the campus.

These lectures, generally given by out of town engineers, offer every student a fine opportunity to learn many things about his chosen field which he cannot pick up in the classroom, while at the same time demonstrating the value of the subjects he is taking. They are particularly helpful in acquainting the student engineers with what goes on in the various fields, so that they can make a more intelligent choice of their future work.

Although the freshmen are probably the most inclined to decide on going to a movie instead of attending a lecture, they are by no means the only guilty ones, and we venture to say that there are a number of seniors who have never gone to one of these evening lectures.

There is in each of the engineering schools an organization, namely the A.S.M.E., the A.I.E.E., the A.S.C.E., and the A.I.Ch.E., whose main reason for existence is to bring these speakers to the campus. You might think that these societies would have trouble getting prominent engineers to come to Ithaca on their own time, but, as a matter of fact, it is far easier to get a good lecturer to give freely of his time than it is to get a reasonable number of students to give up one hour to listen to him. These societies are all doing their best to rouse the interests of the students, and welcome the presence of non-members at their meetings.

To take a specific instance, not long ago a prominent engineer delivered a talk on the development and use of the Diesel engine. This is a field with which almost every mechanical engineer will have some contact, yet only thirty or forty out of some six-hundred M.E.'s bothered to attend, and, had there not been a good number of faculty present, the meeting would have been a flop. Yet those who did attend will tell you that the lecture was extremely interesting and valuable.

Why don't the students attend these lectures? The usual answer to the question is "I had too much work to do that night." But that answer doesn't hold much water when you start to analyze the amount of time each student wastes in bull sessions of just fooling around. The honest answer should have been: "I realized that it would probably be a good lecture, but I was too lazy to walk up the hill again and listen to it."

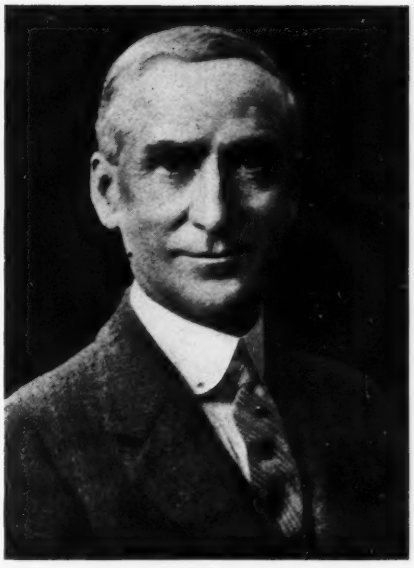
We cannot urge each and every student too strongly to read the announcements of these lectures, and to plan on attending any of them which sound interesting. Not to do so is to throw away a golden opportunity, as there are very few places that the graduate engineer can live that will present so long a list of valuable lectures. If you are one of those many people who has never attended one of these lectures, why don't you gamble an hour of your time, just to find out what they are like? If you still stay away, the chances are that your interest in your chosen field is so slight that you are wasting your time here.

COLLEGE NEWS

At the recent annual meeting of The American Society of Mechanical Engineers held December 4-8, 1939, in Philadelphia, honorary memberships were conferred upon three Americans and one Canadian. We note with a great deal of satisfaction and pride that to the roll of fifteen honorary members, which includes Orville Wright, Herbert Hoover, Alex Dow, and Lord Weir, has been added the name of Dean-Emeritus Dexter S. Kimball of the College of Engineering of Cornell. He received this high honor because "besides a lovable personality, high good humor, fine philosophy, and keen insight into men and affairs, he has made distinguished contributions to engineering progress and to public recognitions of the profession of teaching and engineering."

Dean Kimball, distinguished engineer, teacher, author, and past-president of the A.S.M.E., a national institution of 15,000 members, was graduated from Leland Stanford, Jr. University. After a period of comprehensive training, teaching, and additional training in industry, he came to Cornell in 1904. First as professor of machine design and industrial engineering and then as Dean of the College of Engineering from 1920 until his retirement from that position in 1936, he has been one of the pioneers in industrial management. He has been a member of several societies and councils, has written numerous books and papers, and has received many honorary degrees and awards. We congratulate Dean Kimball for his fine work and for the deserved recognition which he has obtained.

At the same meeting, the A.S.M.E. Gold Medal for 1939, the highest honor which may be bestowed by the A.S.M.E. on an American mechanical engineer, was awarded to James Emmet Gleason, ME '90, president and general manager of the Gleason Works, Rochester, New York, for the development of the hypoid gear. Carl L. Bausch, vice-president, Bausch & Lomb Optical Company, presented Mr. Gleason with the award with the following citation: "Through his technical and engineering contributions, James Emmet Gleason has given distinguished service to the automotive industry by making possible better and safer gear drives. Helped by his keen judgement and kindly nature, he has surrounded himself with an engineering force that has cooperated with him in making their inventions available to the industry through the building of machinery for the production of gears that are found in all parts of the manufacturing world." Mr. Gleason's great contributions began with the patenting in 1905 of a two-tool bevel-gear generator, which was a machine for cutting both sides of bevel-gear teeth at the same time instead of one side only, as in the former types of machines. This was followed by



Dexter S. Kimball, Dean Emeritus

James Gleason's development in 1913 of the spiral bevel-gear generator, the first machine of its kind. The basis of machines extensively used in the automotive and other industries, it contained many elements later embodied in the hypoid bevel-gear generator, another great contribution to gear progress, and for whose development Mr. Gleason received this award. Once again we extend the heartiest of congratulations.

A posthumous presentation of the John Fritz Medal for 1940 for notable scientific and industrial achievement was made to Dr. Clarence Floyd Hirshfeld and received by his son, James Hirshfeld, with the following citation: " for notable leadership through research and development in power generation and electric traction, and for being a great teacher and friend of man, both young and old." Dr. Hirshfeld received the degree of B.S .in E.E. from the University of California and the degree of M.M.E. from Cornell. After teaching at Cornell for ten years, he became head of the Research Department of the Detroit Edison Company, becoming a leader in the development of the modern street car.

To further the discussion of this 60th annual A.S.M.E. meeting, we hope that our engineering faculty was well represented. Dean S. C. Hollister, Professors J. R. Bangs, Jr., J. N. Goodier, H. J. Loberg, F. O. Ellenwood, P. H. Black, and F. G. Switzer attended, all of whom presented or discussed papers. The student representative was J. R. Billings '40, Treasurer of The Cornell Engineer.

(*Continued on page* 28)

CORNELL SOCIETY of ENGINEERS

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"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the college and the alumni."

•

President's Column

Fellow Engineers:

In my last letter I gave the employer's viewpoint on the curricula in engineering colleges. I stressed particularly the objections to specialization in undergraduate courses.

That this is the general feeling among employers, even in highly specialized engineering fields, is emphasized by what Dean Hollister has since told me. He recently visited four of the leading aeronautical industrialists to discuss the desirability of introducing at Cornell a course in aeronautics similar to that which has been established at a few of our technical schools. Somewhat to his surprise, they were all definitely against the idea of attempting to include this in a four year course, giving reasons similar to those advanced in my last letter, and further backing their opinions by citations of experiences with graduates. They all wanted a broad engineering education, based on a thorough training in fundamentals during the first four years; if highly specialized training was to be given, a fifth year should be provided.

Personally, I can vouch for the same feeling of myself and associates in the specialized fields of heating, ventilating and air conditioning. We prefer not to have specialized instruction in these subjects. We do want a thorough and broad grounding in fluid mechanics, thermodynamics and heat transfer.

If we are to be candid, it must be admitted that many of the published college curricula are merely window dressing prepared to attract students. The idea is that the best college is the one which has the most elaborate and extensive curriculum with special emphasis on laboratory courses. Having announced such a full curriculum, good faith must be kept by trying to carry it through. Herein, to my mind, lies the cause of many of the principal defects observed by employers in our present day education. The student is expected to learn more and more in a given time and the courses must be made "easy" so he can accomplish the work laid out in the curriculum. To obtain high or even passing marks, he must memorize extensively . . . he cannot take time to think. The main purpose of an engineering education, a thorough understanding of principles and the training in the use of the mental tools of the profession, is thus defeated. Training in thinking is far more important than the mere acquiring of factual knowledge. Employers do not want human slide rules or walking encyclopedias of engineering knowledge. They want graduates trained in logical thinking, in habits of thoroughness and in the scientific method of approach.

In engineering education the aim should be to have no fact or theory accepted until it is first thoroughly understood. Memorizing without thoroughly understanding does not develop the habit of mind that is so necessary in later life to the successful engineer; on the contrary, it leads to a habit of taking things for granted, and often to a feeling of mental helplessness and inferiority, fatal to mental progress in later life. As a classical example, what did you learn in college about the origin and significance of the constant "e" which appears again and again in engineering formula expressing basic relations? I'll venture that ninety-nine out of one hundred engineering students have accepted it as a mere fact without troubling to get a thorough understanding.

The engineer who advances the boundaries of his profession must have curiosity and an inquiring mind. This natural mental attribute should not be deadened or stultified in the process of technical education, but should be stimulated and developed. The student should be encouraged and required to do everything for himself that he can accomplish through his own mental processes without recourse to text or oral instruction. Teaching, so far as possible, should be through guidance rather than enforced assistance. The inductive method should precede the classical, and commonly overdone, deductive method.

Examinations are useful and necessary but they should lay far greater stress upon a thorough understanding of principles and their application, rather

(*Continued on page* 27)

NEWS OF THE ALUMNI

F. Malcolm Farmer '99, President of the American Institute of Electrical Engineers, was born in 1877 in Ilion, New York, a town of about 4000 inhabitants at that time. His father, an expert gunsmith, came to this country from Birmingham, England, and was connected with the original Remington Arms Company plant at Ilion. His mother was Scottish.

His early days were those of a small-town boy, being uneventful except for such incidents as the usual attempt of embryo electrical engineers of that period to provide all the homes of the neighborhood with electric door bells. Before finishing high school, it became necessary, because of the death of his father, to work in his spare time and during the summers—at such jobs as that of office boy in a lumber yard, general helper in a hardware store and in the gun factory.

He entered Cornell in 1895 on a scholarship and worked during his four years except the latter half of his senior year which was finished on borrowed funds. Those were the days of "Johnny" Morris and the extensive shop practice courses; "Bobby" Thurston and his lectures on thermodynamics which few students understood; and the two Reid brothers, "T-Square" and "Cyclops," who ruled the sophomore kinematic drawing and drafting room with iron hands. Then there were Nichols, Moore and Merritt in physics, "Paddy" Ryan in electricity and Carpenter in experimental engineering. There was little time for extra-curricular activities.

F. Malcolm Farmer's work at Cornell was outstanding and gave promise of the future development that was to mark him as a leader of his profession. Unerringly, he followed the best course for obtaining the fundamental knowledge and breadth of experience needed in his profession. After his graduation from Cornell in 1899 he took a year and a half of post-graduate training on the test floor of the General Electric Company. His starting salary, so-called for want of a better name, was ten cents per hour for five ten hour days and a six hour half day (Saturday) each week. If his time card showed no absence or lateness, he was rewarded with one extra hour's pay.

He topped off his General Electric training with two and a half years of experience as inspector in the United States Government service at the Brooklyn Navy Yard, a service where the omission of the dotting of an "i" or the crossing of a "T" is not tolerated. To further strengthen his knowledge of his subject, he took up night school teaching at Cooper Union in 1902, and continued that hard grind for four years. With this training and background combined with his native ability, his rise in the Electrical Testing Laboratories, which he entered in 1903 as cub engineer, was rapid. Mr. Farmer's association with this well-known concern extends over more than a third of a century. In fact, it is difficult to dissociate him from the Laboratories of which he became chief engineer in 1912 and vice president in 1929.

In addition to his engineering work, but closely linked with it, are Mr. Farmer's interests in the welfare of his profession in research and in standardization. In 1902 he joined the American Institute of Electrical Engineers as an associate member. This was but a stepping stone to his many society activities and affiliations, for he has given freely of his time and energy to the advancement of his profession. In these activities his industry and leadership have borne much fruit. Evidences of these characteristics of the man are his committee memberships and directorships, too numerous to enumerate here, and the facts that he is a past president of the American Society for Testing Materials and of the American Welding Society, and now is president of the American Institute of Electrical Engineers.

His activity in research is shown by numerous papers and contributions; the outstanding piece of work being his A.I.E.E. paper on "Tests of Paper Insulated High Tension Cables," for which he was awarded both the Regional and National Best Paper Prizes. In the field of standardization, Mr. Farmer brought order and is still a guiding influence, through his directorship in the American Standards Association and chairmanship of its Standards Council.

In addition to Mr. Farmer eight other Cornellians have been A.I.E.E. presidents. They include W. A. Anthony, 1890-91, former faculty member; B. J. Arnold, 1903-04, former graduate student; D. C. Jackson, 1910-11, former graduate student; P. M. Lincoln, 1914-15, former faculty member; A. W. Berresford, 1920-21, '93 EE; H. J. Ryan, '87 EE; B. Gherardi 1927-28, '94 EE. and member of the Board of Trustees; and H. B. Smith, 1929-30, '99 EE.

(*Continued on page* 27)

Use The Cornell University Placement Bureau

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SENIOR PERSONALITIES

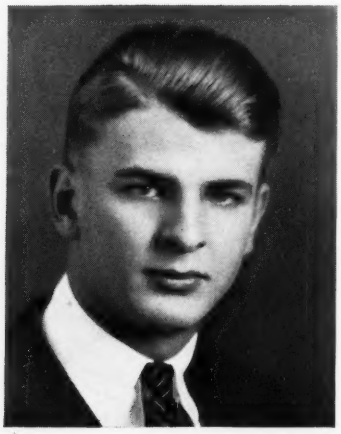
WILLIAM H. WORCESTER '40, A.E.M.E.

When next fall rolls around, Bill Worcester is going to miss something, and that's football. He's been playing it for four years at Cornell, and climaxed his football career with the biggest thrill of his life—starting in the memorable Penn game. Other engineers agree that it is a pretty tough job to stay in the first quarter of an engineering class and play varsity football too. However, Bill finds that his grades are better during the football season than after, for then he realizes that every minute counts and doesn't put his work off, thinking he has so much time.

Another sport which ranks high with Bill is rugby. The rugby team, which was formed last spring, is not supported by the Athletic Association, but is run by the players which constitute the Rugby Club, of which Bill is president. The team had its difficulties at the first, for no one knew much about the game. The referees were kind enough in several games to stop play and help the Cornell players with some of the rules. Bill went along with the team to Bermuda last Easter when the Bermuda Rugby Association asked the Cornell, Yale, Princeton, and Harvard teams to participate in the Rugby Week games. The boat on which the team was to return had to be held, since Cornell was still playing in the finals. The players then had to rush on board still wearing their uniforms.

Bill has used his summers to good advantage, working two years for the Norton Mfg. Co., one in the heat treatment department, and the other in the drafting room. He found that these jobs tied in very well with his course at Cornell. Upon graduation he plans to enter the field of sales engineering.

A member of Chi Psi fraternity, Bill will soon join the other seniors in the sad song of "And we soon will be leaving this school of Cornell."



WILLIAM E. FISHER '40, C.E.

As we stepped out of the elevator on the sixth floor of Lyon tower, "Beethoven's Seventh Movement" greeted us, and in the background, Bill Fisher's voice called, "Make yourselves comfortable. Be ready in a moment."

While waiting we looked over his room and noticed a large number of classical phonograph records. Collecting these is one of his chief hobbies, and he later told us that there were over a hundred records on the shelves. Bill also told us that his other extra-extra-curricular activity is skiing. Perhaps by the time this issue "hits the newstands" his skiis will have been given a workout.

Another interesting discovery was a group of five shingles indicating membership in Tau Beta Pi; Aleph Semach; Chi Phi, his fraternity; Quill and Dagger, of which he is secretary; and Chi Epsilon, of which he is president.

By now Bill "had his pants on", so he came forth to tell us that he hailed from Stevens Point, Wisconsin. As any good Wisconsin man should, he has taken numerous lengthy canoe trips through the state, several with fraternity brothers. Perhaps these canoe trips have given him the physical background needed to become a member of the varsity crew. An oarsman for the past two years, Bill has earned himself a considerable reputation as a "good man" and many friendships that will last for the remainder of his life. The "crew" is in his blood now, and he is, of course, a member of the Crew Club.

Bill has also distinguished himself scholastically, having held a McMullen Scholarship for the past four years, in addition to membership in the afore-mentioned honor societies, Tau Beta Pi and Chi Epsilon.

If all goes well in the future, Bill will enter law school, feeling that his engineering background will prove excellent preparation for this field.

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PROMINENT PROFESSORS

PROFESSOR J. R. MOYNIHAN

In Sibley Dome there is an office where, at one time or another, nearly every engineer in Sibley College finds his way—the Personnel and Placement Office, to meet and talk with J. R. Moynihan. To the left of the door are rows of steel filing cabinets containing the very intimate records of Cornell engineering students and grads—to the right of the door is an office and a big desk. Behind it is Jack Moynihan.

Born in Buffalo in 1906, he wended his way through childhood and high school, to start at Cornell in 1922 . . . emerging in 1926 with the degree of Mechanical Engineer, which was supplemented in 1932 with a Master of Mechanical Engineering. The Athletic Association saw fit to reward his basketball playing with the "C" while he was an undergraduate, and he liked the sport so well that on his return to Cornell as an instructor in 1929 he assumed the charge of Varsity Assistant Coach, which he held until 1936. Not limited in his sports ability, Moynihan plays golf during the Ithaca dry season, and claims a pro's score, too.

They who toil in the Mechanical Labs know the professional slant of this professor—for, in addition to regular work, he has done not a little research work, both in collaboration and by himself. Strictly speaking, Asst. Prof. Moynihan is a Professional Engineer (by examination in New York State), a member of the Society for the Promotion of Engineering Education, the American Society for Metals, Tau Beta Pi, Sigma Xi, Atmos, and Sphinx Head. His social fraternity is Pi Kappa Alpha.

Then there is Jack Moynihan's personnel work in Sibley College—when we called on him, he showed us file after file of grad records, each from entrance to Cornell to the present time. No sketchy organization is this Personnel Department, and all because of those who oversee it, he being one of the five. Standing there, peering into a folder, the typical worker that he is, he tells us that scholarship is the mainstay of employment, quickly followed by personality—and that it is his job to help improve the latter. Two objectives

(*See next page*)

PROFESSOR R. Y. THATCHER

Probably everyone has speculated on those elegantly clad dignitaries who grace the arena at the Cornell indoor track meets. Professor R. Y. Thatcher's presence is due mainly to an intense interest in track which brings him to almost every Cornell track function. This interest dates back to his student days at Cornell when he was a member of one of Coach Moakley's championship cross-country teams. Professor Thatcher claims that the boys trained harder in those days. Proof is the daily eight mile practice run and the post-season marathon from Dryden—a grind in which he finished fifth.

Although such athletic participation was admittedly strenuous, he managed to maintain a high scholastic record as evidenced by his holding two scholarships. In addition he was actively engaged in debating. Being interested in railroading, he intended to make this field his life's work. Accordingly, after graduation he went to work in Buffalo for the New York Central Railroad. After six years he moved to Washington, D. C. and for three years engaged in railroad evaluation work in the employ of the Interstate Commerce Commission. In 1918 he returned to his native city, Buffalo, to take a position with the Lackawanna Steel Company. Here it was that he first became interested in the subject of engineering law due to his handling much legal work in connection with his civil engineering work.

In 1924 Professor Thatcher came to Cornell to teach civil engineering, his chief interest at present being Engineering Law. Although he has never regretted changing to teaching, he keeps closely in touch with the active field of engineering by doing summer work such as surveys of private property, accident surveys, and consulting.

Outside the classroom he is kept busy by the chairmanship of the Faculty Committee on Student Activities, and membership on civil engineering committees, the ASCE, Tau Beta Pi, Chi Epsilon, and Rod and Bob.

Professor Moynihan

he has in mind: to prepare students for jobs, and to obtain jobs for the students—two objectives Jack Moynihan accomplishes. Perhaps no better picture could be taken of him than bending over a file, or passing advice across the desk to a senior in hope.

Professor Thatcher

In the midst of these activities he finds time for gardening and bowling, his favorite pastime. Bowling on the University Faculty Team, he has chalked up the year's highest score in the league. He slyly intimates that it is not safe to invite him to any function whatsoever that happens to fall on bowling night. On such nights one can find this genial professor, pipe in mouth, mowin' 'em down on the local alleys.

The Engineer In Ordnance

(*Continued from page* 8)

In all of these—research, development and design; construction of the factory, the machine tools, the machinery, the production line, and the final product, the engineer is definitely required.

THE RESERVE OFFICER

So far, the question of what the engineer can do toward preparedness has been discussed in generalities. Available to each of you, who is an American citizen, is membership in the Army Ordnance Association. It is "a national society of American citizens pledged to industrial preparedness against war as our strongest guaranty of peace . . . to foster an understanding of industry's role in our national defense among scientists, engineers, inventors, manufacturers . . . stimulating interest in the design, production and maintenance of our weapons of defense."

Concretely, it is recommended that the engineer student train to become a Reserve Officer. There is a definite field for each of you—the Electrical Engineer in the Signal Corps, the Civil Engineer in the Corps of Engineers, the Mechanical Engineer in the Ordnance Department, and the Chemical Engineer in either the Ordnance Department or the Chemical Warfare Service. By associations and training you learn to know the needs of the army, and can apply the knowledge and experience of your profession to greater advantage. Courses are available in only the Signal Corps and Ordnance Department of the Reserve Officers' Training Corps at Cornell University. However, training should be continued in the Field Artillery or Infantry as substitutes for the strictly engineering courses when no vacancies or courses exist for the latter. Particularly in the Field Artillery, there is a need for technically trained men. After graduation and commission in the branch in which training has been received, there will be ample time and opportunity to decide upon transferring to some technical branch.

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The recently commissioned officers of the Ordnance Reserve are usually assigned to ammunition, depot, or maintenance companies. Later, as they gain experience in their professions, they may be assigned to arsenals, loading plants, procurement districts or proving grounds. The requirements for these positions are varied and where possible will be parallel to the work the reserve officer is pursuing in civil life. Chemists, metallurgists, foundrymen, production managers, inspectors and many other professions will be found among the qualification requirements of the officers so selected. Every effort is made to give the reserve officer active duty training at his place of assignment. This has proved to be beneficial to the government and to the individual, as training of this type permits the officer to assume the position he would hold in the event of an emergency and to perform the duties of that position.

Whether we like it or not, the world is full of wars and rumors of wars. Any European war is far reaching and the extent of the present holocaust is unpredictable. It is impossible to ignore the situation, and the role of an ostrich does not become the citizen of today. He must be alive to conditions as they exist and do all in his power, individually and collectively, to keep this country at peace. In my opinion, the initial step towards peace is preparedness.

Reclamation and the Engineer

(*Continued from page* 13)

12.8 miles of railroad, 357.8 miles of transmission lines, 71.7 miles of pipe lines, 11,307 canal structures, 290 bridges, 992 culverts, and 96 flumes.

The Bureau placed in dams 3,622,208 cubic yards of concrete, 5,257,400 cubic yards of earth, and 1,484-976 cubic yards of rock; 40,260,162 cubic yards of earth and rock were excavated. The bureau used 3, 842,175 barrels of cement.

An outstanding project under construction was the Grand Coulee Dam on the Columbia River in Washington which upon completion will be the largest, and with a maximum height of 553 feet, the third highest crete dam in the world. The second major contract, one for completion of the dam, left power house, and foundation for the pumping plant, awarded early in 1938, was in progress and was about 38 percent complete at the end of the fiscal year, June 30, 1939. Ultimately the Columbia Basin reclamation project, for which Grand Coulee Dam will store water, will irrigate 1,200,000 acres of land.

Another major undertaking of the Bureau in progress was the Central Valley project in California, designed to alleviate critical water shortage and to solve other water problems in important agricultural areas through the conservation of flood waters of the Sacramento and San Joaquin Rivers. The estimated cost of the project is $170,000,000. Construction features include Shasta Dam, reservoir, and power plant; 200 miles of transmission lines; a delta cross-cut canal to carry Sacramento River water to the San Joaquin River; the Contra Costa Canal; the San Joaquin pumping system; Friant Dam and reservoir; the Madera and the Friant-Kern Canals.

Shasta Dam, located about 9 miles north of Redding, California, was about 25 percent complete at the end of the fiscal year. It will be 560 feet in height, 3,500 feet in length along the crest, and will contain a volume of 5,400,000 cubic yards of concrete, the second highest and the second most massive concrete structure in the world. Work was in progress on the 46-mile Contra Costa Canal and on the Southern Pacific Railroad relocation around Shasta Dam reservoir site; and in November 1939 construction was begun on Friant Dam, which will be 300 feet high, 3,430 feet long and contain 1,900,000 cubic yards of concrete.

At Boulder Dam, the highest dam in the world, located on the Colorado River in Arizona and Nevada, electrical equipment was being installed in the power plant. The present plant installation consists of six 82,500 kilowatt generators in the Nevada wing, and two 82,500 kilowatt generators and one 40,000 kilowatt generator in the Arizona wing, a total of 700,000 kilowatts, making the Boulder Dam power plant the largest operating in the world. Ultimately there will be 15 of the large and two of the small generating units in operation, with a capacity of 1,317,500 kilowatts.

Despite the engineer's function in this immense construction work, the value of the reclamation program is and must be judged by the social and economic results of the construction and not by the construction itself. The significance of the Federal reclamation program lies in these facts: We have made homes for more than 900,000 persons on 52,552 farms and in 258 towns and cities by the irrigation of more than 3,000,-000 acres of land in projects scattered throughout the arid West.

Using water which otherwise would be wasted, perhaps in destructive floods upon lands which otherwise must have remained useless desert, these opportunities have been created. Since this work began in 1902 crops valued at nearly $2,500,000,000, more than 10 times the cost of the irrigation works of the projects which are now being operated, have been harvested and marketed by the farmers in these irrigated areas. This means the addition of a tremendous amount of wealth to the country as a whole.

Projects now being constructed by the Bureau will add approximately 2,300,000 acres to the cultivated area of the arid and semiarid states. In addition, supplemental water will be provided for about 1,700,000 more acres which now have insufficient water to produce good crops. When completed, these new projects should make available opportunities for an estimated 825,000 people on 41,600 farms and in the cities and towns which will grow up among these farms.

Incidental to its irrigation work, the Bureau of Reclamation has provided on 13 projects, power plants which furnish cheap energy to light the rural homes and run the farm machinery, as well as to operate the pumps and gates of the irrigation system itself.

With so much depending upon the success of the Reclamation program, its administration is a grave responsibility. The water supply of the western one-third of our country is severely limited. The land resources of that area are so great by comparison that literally hundreds of millions of acres can never be used. Of 700,000,000 acres in the arid and semiarid West, 20,000,000 acres now are developed by irrigation. It is estimated that the remaining unused water resources will irrigate with projects which by present standards can be regarded as feasible only an additional 10,000,000 acres. The selection of the lands which are to be developed in the future is a serious matter.

From the beginning of Federal reclamation, the administration and execution of this policy has been in the hands of men recruited from the engineering profession. Its achievements to date and the success or failure of the program in the future, to a great extent, will be the responsibility of the nation's engineers.

Alumni News

(*Continued from page* 21)

The English journal "Engineering" which was recently received from London contains an account of the life and works of Dr. Robert Henry Thurston along with his portrait and an announcement of the new edition of his book "The History and Growth of the Steam Engine," published by the Cornell University Press. The article was inspired by the Centennial celebration held at Cornell University on October 25. The celebration itself is reported in a two-page article in the December issue of *Mechanical Engineering*, official organ of the A.S.M.E. and in the October issue of the CORNELL ENGINEER.

It is always interesting to hear about our alumni in far away China. The December 11 issue of LIFE contained a photograph of a steel traveling crane in a steel mill located behind the Chinese lines in the interior of China. The traveling crane was designed and built by Shen-How Fong '27-'28 MME., assistant manager of the steel mill.

On November 28th at a meeting attended by 100 alumni of the College of Engineering, the formation of a Syracuse section of the Cornell Society of Engineers was announced. The officers of the new section are Chairman Colonel Henry B. Brewster '98, manager of the New York Industrial Exhibit Authority; Vice Chairman E. Austin Barnes '99, purchasing agent of the Solvay Process Corporation; Secretary and Treasurer C. Francis Brown '26, head of the Method and Time Study Department, L. C. Smith and Corona Typewriters, Inc.

Willis H. Carrier '01, President of the Cornell Society and host to the meeting, and Professor John R. Bangs '21 spoke to the gathering. Professor Bangs and Dean S. C. Hollister spoke at a similar meeting in Philadelphia on December 7th.

President's Letter

(*Continued from page* 20)

than of factual knowledge or facility in engineering calculations. Where a passing mark of 60% is now required indiscriminately, there should be two examinations, the first, to test the thorough *understanding* of essential principles, should require a passing mark of 80%, and a second on factual knowledge and on facility in engineering calculations may require only 60%. This is based on the theory that a man who doesn't *understand* what he is doing will never make an engineer.

In my next letter I propose to discuss the character of college entrance requirements and its relationship to instruction in secondary and preparatory schools.

Very truly yours,
WILLIS H. CARRIER,
President

This strong, durable steel tape is unquestionably the finest light weight steel tape made. Line is only ¼" wide. Either the 25' or the 50' tape fits conveniently in your vest pocket, is handsomely finished in genuine, selected brown leather. It is so attractive and yet so practical that it is often purchased for fine gift purposes. See it at your dealers. Write for Catalog 12A.

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Employment After Graduation

(*Continued from page* 11)

helpful to this group. A record of each undergraduate is maintained, and later on his alumni record is added, when this information becomes available as a result of the follow-up system.

In addition, many of the non-resident lectures for seniors are devoted to the subjects of preparation for seeking employment and of training programs for the young engineer in industry. The lecturers are trained personnel men from industry, who are active in the hiring and training of college graduates.

OUTLOOK FOR 1940

Naturally all of the seniors are interested in the answer to the question: What are the prospects for the 1940 engineering graduate? Judging from the business index and the opinions of business economists, the members of the Class of 1940 may expect a good year in employment. The activity should at least equal that of last year and may approach that of 1937. However the senior must realize that, whether prospects are good or bad, it is necessary for each individual to be adequately prepared in all respects.

College News

(*Continued from page* 19)

The following men were elected to Chi Epsilon, honorary civil engineering society:

Class of 1940

Eugene S. Thorpe
Edward R. Skotarczak

Class of 1941

Robert T. Clark
Richard G. Davis
Howard F. Eckerlin
Edmund B. King
H. Warner Lansing
Walter B. Shaw

General News

The recent election to select junior members of the Executive Committee of the Student Engineers' Council resulted in the addition of the following new members: N. Travers Nelson, M.E.; Edmund E. Friedrich, E.E.; H. Warner Lansing, C.E.; and George A. Gentes, Ch.E. The appointment of Robert C. Ross to represent THE CORNELL ENGINEER completes the membership of the Executive Committee, composed of ten students and five faculty members, who will have charge of the Cornell Day Engineering Show, the Engineers' Ball, and similar events.

Student government in the Civil Engineering School has been making considerable progress, following a general shake-up, re-organization, and simplification of previous years' set-up. Most recent has been the election of Paul Swatek '40 as president and Paul W. Leighton '42 as secretary of the Central Committee, which is composed of the presidents and secretaries of the classes. Other members are William Gay '40, Paul Simmons '41, Warner Lansing '41, William Young '42, Clarence Huxley '43, and John Ingles '43. Huxley and Ingles were elected this fall; the others were elected last spring. The Central Committee has drafted a constitution for student government in the School of Civil Engineering and has submitted it for ratification to the student body of that school. At present they are making extensive plans for the Civil Engineering banquet to be held January 9, 1940.

We should like to extend our felicitations to the recently elected members of Chi Epsilon. At the initiation banquet held in the Dutch Kitchen December 12, Prof. R. H. Rhodes, Director of the School of Chemical Engineering, departed from the more serious side of the subject in his meandering, entertaining "Philosophy of Engineering." Everyone derived a great deal of enjoyment from his stimulating comments.

What The Societies Are Doing

At a joint meeting of the Ithaca Section and the Cornell Student Branch of the A.S.M.E. December 6, Prof. C. W. Mason illustrated his talk on "Crystal Growth" with slides in a micro-projector. By the use of this apparatus, which employs polarized light, Prof. Mason was able to throw on the screen highly magnified and multi-colored images of actual crystals forming in minute drops of liquid. The formation is analogous to that which takes place in the cooling of metals and is therefore important in the study of metallurgy. Student officers will be elected at the next meeting.

Following the organization meeting on November 30, for the purpose of planning policies for the coming year the Student Branch of the A.S.C.E. heard Herbert E. Snyder on December 14 relate the activities of the society and how the junior society tied in with the alumni society.

STRESS and STRAIN

Oh, papa slipped upon the ice,
Because he could not stand.
He saw the glorious stars and stripes,
We saw our father land.

—*Rose Technic*

Making love is like making pie.

All you need is a little dough, a little more crust, and plenty of applesauce.

"Were you excited when you first asked your husband for money?"

"Oh, no, I was calm and collected."

I had a bunny;
His name was Jim.
Got sixteen now;
Her were no him.

—*The Pointer*

Dis is spring,
De boid is on de wing.
How absoid,
De wing is on de boid.

The Esquimos from the North Pole and the Esquimos from the South Pole decided to have an international congress of Esquimos to meet on the Equator. As the two parties met, the leader of the North Pole Esquimos said in greeting;

"Glub, glub."

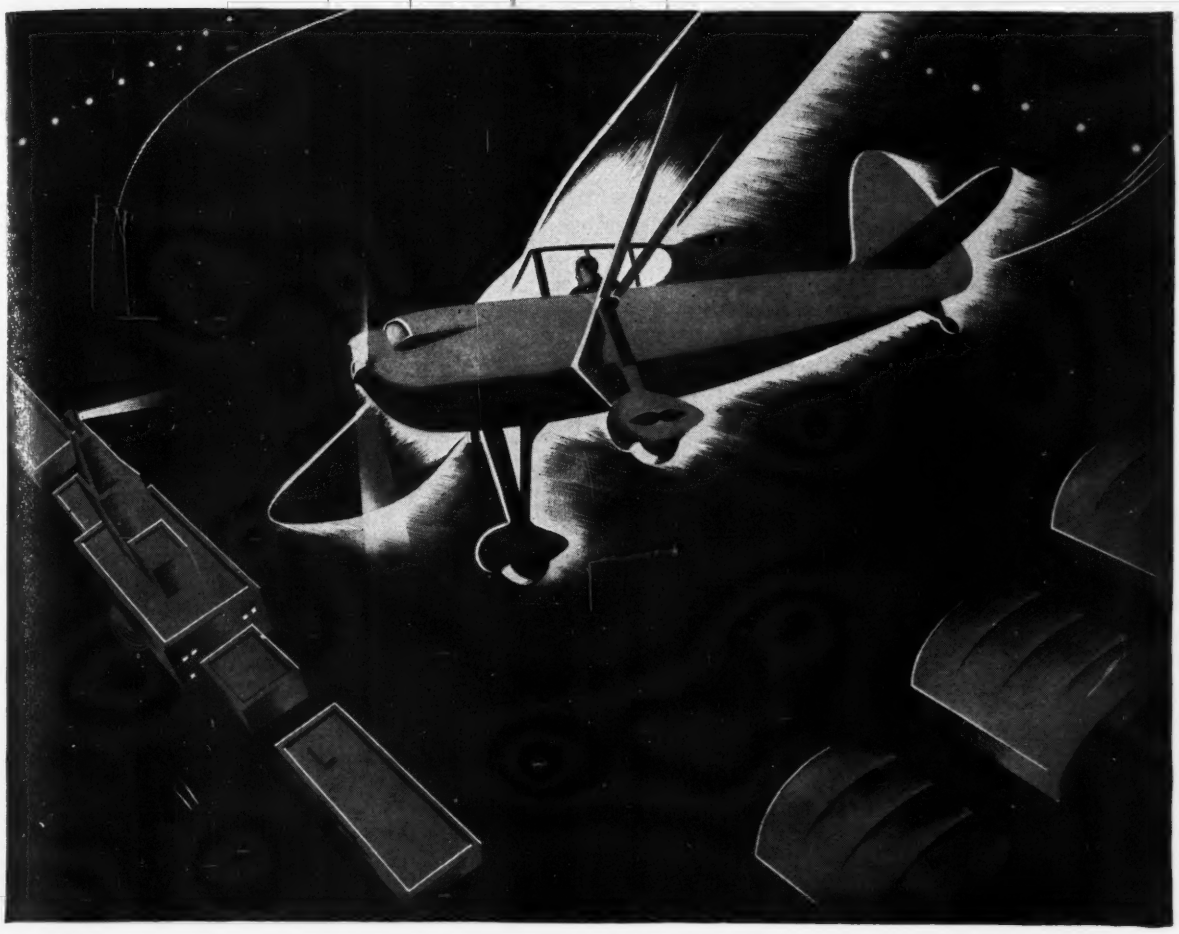
To which the Southern Esquimos replied:

"Glub glub, y'all."

—*The Pointer*

There is a freshman in South Baker who thinks that a neckerchief is the president of a sorority.

A homely co-ed who is very popular either has a wonderful personality.



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G-E Campus News

EXTRA-SPECIAL DELIVERY

TO most people, the mailman is a fellow who rings the doorbell or toots a whistle or stops at roadside boxes. But to Rear Admiral Byrd and his expedition the mailman is a chap thousands of miles away.

The Admiral's mail, you see, is delivered by one of General Electric's world-famous short-wave stations at Schenectady, just as was done for the two previous Byrd expeditions. The letters are read from WGEO every other Friday, 11 to 11:45 p.m., EST, under the direction of station manager Eugene S. Darlington, Oregon State ex-Test man, and John R. Sheehan, Union '25, program manager.

A General Electric all-wave receiver on both the *Bear of Oakland* and the *North Star*, the party's ships, are the actual mailboxes. They will later be installed at the expedition's two camps. WGEO's mailman invites friends and relatives to send messages to the Byrd Antarctic Mailbag, General Electric, Schenectady, N. Y., for transmission to the expedition. Fifty words is the maximum.

PRIZE PACKAGE

FAME is nothing new to Brazil. She is not only the world's leading coffee grower, but also the largest state in South America, being 250,000 square miles bigger than continental United States.

Fame also is nothing new to General Electric's transportation department, headed by Guy W. Wilson, Penn State '23 and ex-Test man. In all parts of the nation, the products of this G-E division can be seen in operation. Therefore, what is more natural than for these two parties to get together? They have — frequently. Their latest bit of co-operation is represented by four G-E direct-current locomotives, the world's most powerful, scheduled for delivery this month to the Paulista Railroad in Brazil. These 185-ton locomotives have a continuous rating of 4200 horsepower and a maximum speed of 93 miles per hour.

NAUTICAL MOTOR

DIFFERENT though the sailing ships of a century ago were from the express liners of today, the two have many things in common. Among their points of similarity is a need for emergency pumps, for water may sometime get where it doesn't belong because of a collision or other accident.

A far cry from the hand-operated pumps of old is the equipment which will be part of the S. S. *America*, the United States Lines' new 723-foot superliner, the largest ever built in American yards. Mounted 80 feet below the liner's boat deck, a G-E 40-horsepower motor will drive an Aldrich pump capable of emptying 900 gallons of flood water per minute. The motor and pump will empty all compartments through a system of piping reaching all parts of the ship. Other G-E equipment on the *America* includes 150 auxiliary motors and controls for such equipment as winches, refrigeration machines, and steering apparatus.

These applications are typical of the thousands of uses to which General Electric motors have been successfully applied. And an important reason for this success is the vast amount of motor-test data contributed by the young engineering college graduates on the G-E Test Course.

GENERAL ELECTRIC

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